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UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN FRANCISCO DIVISION

WAYMO LLC, Plaintiff, v. UBER TECHNOLOGIES, INC., OTTOMOTTO LLC; OTTO TRUCKING LLC, Defendants.	Case No. 3:17-cv-00939-WHA **SUPPLEMENTAL DECLARATION OF MICHAEL LEBBY IN SUPPORT OF DEFENDANTS' SUR-REPLY TO PLAINTIFF WAYMO LLC'S MOTION FOR PRELIMINARY INJUNCTION** Date: May 3, 2017 Time: 7:30 a.m. Ctrm: 8, 19th Floor Judge: The Honorable William Alsup Trial Date: October 2, 2017

REDACTED VERSION OF DOCUMENT SUBMITTED UNDER SEAL

I, Michael Lebby, Ph.D., declare as follows:

1. I have been asked by counsel for Defendants Uber Technologies, Inc. ("Uber"), and Ottomotto LLC ("Otto") and Otto Trucking LLC (collectively, "Defendants") to provide certain opinions in the above-captioned case in connection with Waymo LLC's ("Waymo")[1] Reply In Support of Its Motion for a Preliminary Injunction ("Reply") and the Reply Declaration of Mr. Gregory Kintz in Support of Waymo's Motion ("Kintz Reply Declaration"). I submit this declaration in support of Defendants' Sur-Reply to Waymo's Motion. I have personal knowledge of the facts set forth in this declaration and, if called to testify as a witness, could and would do so competently.

I. MATERIALS CONSIDERED

2. In forming my opinions and views expressed in this declaration, I have reviewed and considered Waymo's Reply brief, the Kintz Reply Declaration, the deposition transcript of Mr. Kintz ("Kintz Dep. Tr."), the deposition transcript of Daniel Gruver ("Gruver Dep. Tr."), Supplemental Declaration of James Haslim ("Supplemental Haslim Declaration") and exhibits, the Supplemental Declaration of Scott Boehmke ("Supplemental Boehmke Declaration") and exhibits, the materials identified in my opening Declaration, and other materials and information that are identified in Exhibit 1 to my opening Declaration and referenced in my opening Declaration. I have also spoken with Mr. Haslim and inspected the Fuji device and the Spider components in person. In addition, I reviewed the fifty Waymo files attached as Exhibit 27 to this Declaration.

II. DIFFERENCES BETWEEN THE FUJI AND [redacted]

3. Mr. Kintz opines in Paragraph 38 of his Reply Declaration that I failed to counter his opinion that the Fuji transmit printed circuit board (PCB) was a scaled-up version of the [redacted] design. According to Mr. Kintz, I only stated that the Fuji PCB edges have different curvatures than the [redacted] edges. I disagree. In Paragraphs 60 to 62 of my opening Declaration, I identify many differences between the Fuji PCB and the [redacted] PCB. I also state in Paragraph 62 of my

[1] As used in this declaration, the term "Waymo" includes Google.

declaration that a comparison of the diode location and angle information for the Fuji in Haslim Declaration Ex. B and the [redacted] in Jaffe Declaration Ex. 2 shows that the two systems were designed for different fields of view and have different positioning of diodes.

4. Mr. Kintz failed to make the same comparison of the actual diode location and angle information for all the boards that I did, and he conceded at deposition that [redacted]. (Ex. 2, Kintz Dep. Tr. at 99:13-23.) Instead, in Paragraph 38 of his Reply Declaration, he continues to opine that [redacted] (At his deposition, Mr. Kintz acknowledged that the [redacted] (*See* Ex. 2, Kintz Dep. Tr. at 38:16-22.))

5. Mr. Kintz is wrong about Fuji's focal length. As stated in Exhibit E (Fuji beam spacing and angle summary) to the April 7, 2017 Declaration of Mr. Haslim, the focal length of the Fuji is [redacted] mm. (Haslim Decl. Ex. E at 3 [redacted] Supp. Haslim Decl. ¶ 11.) Mr. Kintz's [redacted] (Ex. 2, Kintz Dep. Tr. at 40:11-20.) Mr. Kintz [redacted] (Ex. 2, Kintz Dep. Tr. at 46:14-18.) [redacted]

6. As noted in Paragraph 62 of my original declaration and further explained below, the diode angles and angular spacing in Fuji and [redacted] are entirely different.

7. Some of the most notable differences between the Fuji and [redacted] designs in critical parameters include: (1) different vertical field of view (FOV); (2) different focal length; (3) different vertical angles for nearly every laser diode on every transmit board; (4) different angular delta between diodes; (5) different minimum spacing between diodes; and (6) different layout of

components and conductive tracks. I summarize some of these differences in the chart below, including an exemplary comparison of one board from the [redacted] and one board from the Fuji mid-range cavity [redacted]:

	[redacted] LiDAR	Fuji LiDAR
Block Configuration	[redacted]	[redacted]
Vertical FOV	[redacted]	Medium: -22° to -4.22° (total 17.78°) Long: -3.92° to 8.23° (total 12.15°) Total: 30.23°[5]
Cavity Tilt	[redacted]	-12°
Focal Length	[redacted]	150mm[7]
Diode Spacing	[redacted]	[redacted]
Diode Angles	[redacted]	[redacted]
Minimum Diode Spacing	[redacted]	[redacted] 3mm
Diode Pattern	[redacted]	[redacted]

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[2] Kintz Decl. ¶ 38.
[3] Haslim Decl. ¶¶ 7, 11.
[4] Jaffe Decl. Ex. 1 ¶ 38.
[5] Haslim Decl. ¶ 15.
[6] Kintz Decl. ¶ 47
[7] Haslim Decl. Ex. E at 3 [redacted]); Supp. Haslim Decl. ¶ 11.
[8] Jaffe Decl. Ex. 2 at 16. From the table entitled [redacted] Haslim Decl. Ex. B. Angles for boards A-F are in the "theta" columns. Based on my conversation with Mr. Haslim, signs shown for angles in boards A-C are reversed (i.e., positive is negative and vice-versa).
[10] Jaffe Decl. Ex. 1 ¶ 4.
[11] Haslim Decl. ¶ 11.
[12] Jaffe Decl. Ex. 2 at 16.
[13] Haslim Decl. ¶ 13.

III. WAYMO'S NEW TRADE SECRET ALLEGATIONS

8. Mr. Kintz opines in Paragraphs 55-79 of his Reply Declaration that Uber's LiDAR devices use additional trade secrets that were not identified in his original Declaration. In the paragraphs below, I respond to Mr. Kintz's opinions with respect to these new trade secret allegations.

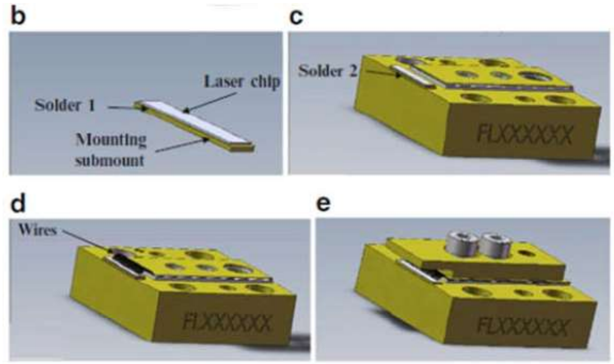
A. [redacted]

Waymo claims: [redacted]

9. Mr. Kintz states in Paragraphs 56 to 57 of his Reply Declaration that the concept of [redacted] is a Waymo trade secret. I disagree with Mr. Kintz. The use of [redacted] is a known design choice in the field of diode lasers and has been discussed in public literature.

10. Bond pads and other submounts for diode lasers are used to ensure proper mounting of the diode on the substrate and facilitate adequate thermal contact. The [redacted] is well-known. U.S. Patent No. 5,940,277 describes how "[b]ond pads 14a, 14b, 14c, etc. may be disposed a short distance from edge 15, or their lower edges may be flush with edge 15." (Ex. 3, '277 patent at 3:55-58, Figure 1a.) U.S. Application No. 2007/0158807 discloses "a plurality of metal pads on the [top/bottom] surface extending to an outer edge of the [top/bottom] surface." (Ex. 4, '807 application, Claim 1.)

11. The Liu Textbook discusses the properties of submounts and discloses an example of a [redacted] of the substrate. Fig. 7.32 (p. 212), excerpted below, shows a laser chip placed on a [redacted] of the underlying substrate. (Ex. 4 to opening Declaration at 212.)



12. A specification sheet for the a PCO-7110 laser diode drive module from Directed Energy, Inc. describes how, "[t]o facilitate different packages and mounting preferences, there are two solder pads on the end of the board to accept various laser diode packages mounted on axis to the driver." (Ex. 5, PCO-7110 manual at 2.) Figure 3 shows how the [redacted], and Figure 5 illustrates how a laser diode would be placed on the [redacted] in an axial mount position.

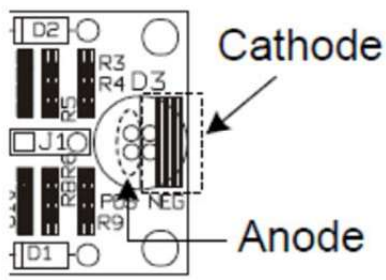


Figure 3. Cathode and Anode Pads on the PCB

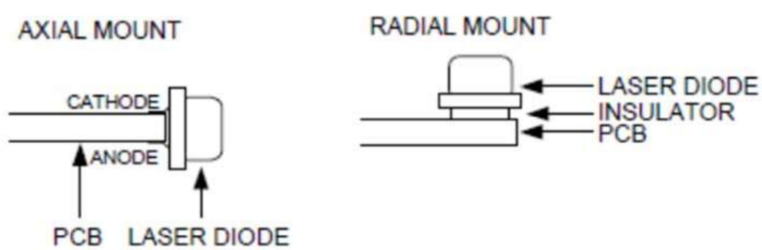


Figure 5. Axial and Radial Mounting Positions

13. Furthermore, I have reviewed the supplemental declaration of Mr. Boehmke, and he describes a circuit board layout created at Uber on March 29, 2016, before Uber's acquisition of Otto. As illustrated below in Figures 5.A and 5.B from the Supplemental Boehmke

Declaration, this circuit board layout placed the [redacted]. (Figure 5.B is an enlarged version of a portion of Figure 5.A.) (Supp. Boehmke Decl. ¶ 8.)

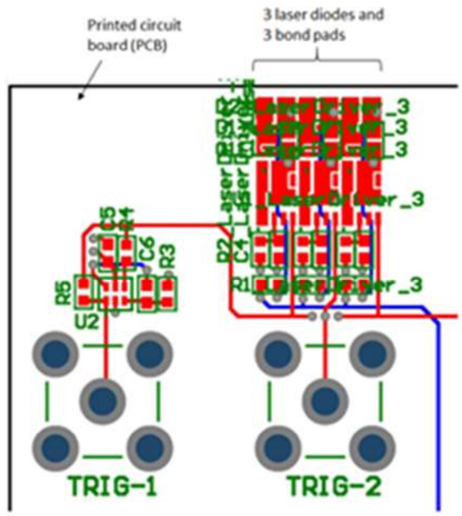


Figure 5.A

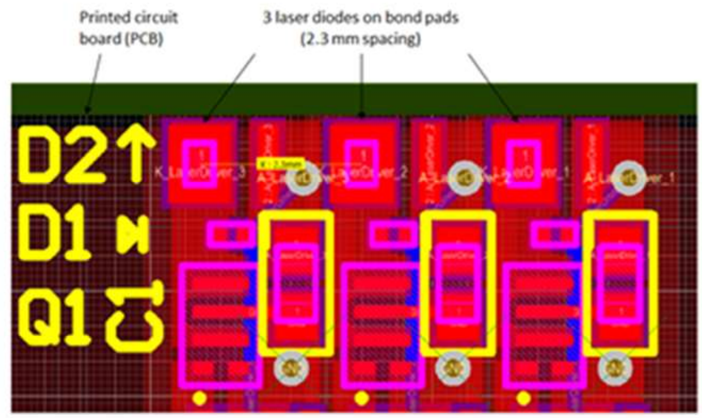


Figure 5.B

14. This design demonstrates Uber's independent development of [redacted] and shows that Uber did not use Waymo's alleged trade secret.

B. [redacted]

Waymo claims: [redacted]

15. Mr. Kintz states in Paragraphs 58 to 63 of his Reply Declaration that the concept of [redacted] is a Waymo trade secret. I disagree with Mr. Kintz.

16. As I discussed in Paragraph 66 of my opening Declaration, the use of [redacted], such as fast-axis collimating (FAC) lenses, is commonplace in the design of laser systems. (At deposition, Mr. Kintz [redacted] (Ex. 2, Kintz Dep. Tr. at 106:25-107:6.)) There are numerous vendors that sell FAC lenses and the use of such lenses in connection with laser diodes is widely known and disclosed even in publicly-available vendor specifications, such as

the one I referenced from Hamamatsu. In response, Mr. Kintz opined that [redacted] qualifies as a trade secret.

17. First, I note that neither Mr. Kintz nor Waymo's Trade Secrets List identifies the specific [redacted] Waymo claims to be a trade secret. Instead, Mr. Kintz only states that the steps include "an [redacted] that results in a [redacted] that is [redacted] (*Infra*, ¶¶ 59, 62.) Mr. Kintz [redacted]. Injection molding to create lenses is a well-known technique in optical component manufacturing.[15] As Mr. Kintz stated during deposition, [redacted] (Ex. 2, Kintz Dep. Tr. at 203:5-204:4; '922 patent at 15:19-20, 15:50-55.) Instead, he appears to claim that [redacted] I disagree.

18. U.S. Patent No. 5,420,722, which issued on May 30, 1995, discloses a "cylindrical microlens [] mounted directly to a laser diode die." (Ex. 6, '722 patent at 1:59-60.) The shape and positioning of the microlens is illustrated in Figure 2, reproduced below. The laser diode (1) emits laser light along the arrow lines indicated in the figure. The cylindrical microlens (4) is shaped so as to be mounted over the top and in front of the laser diode. The patent states: "Microlens 4 is permanently bonded to die 1 using an adhesive 11." (*Id.* at 2:5-7.) The microlens has a cylindrical surface (8) that collimates the laser light emitted from the diode. The patent notes that the invention "can be used with molded lenses." (*Id.* at 2:41-43.)

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[14] In fact, the [redacted]. (Ex. 2, Kintz Dep. Tr. at 198:1-11.)

[15] Millions if not billions of injection-molded lenses that are positioned in front of laser diodes can be found in common optical storage products today. These would include CD players, DVD players, and Blu Ray players, where the semiconductor laser diode emits light that passes through an injection-molded optical lens before reaching an optical disk. Plastic-based injection-molded lenses are a huge industry for many different industrial, consumer, and technical markets and can be found in many products where volumes of lenses are significant. Good examples of the use of highly accurate, low cost, injection-molded optical lenses that specifically deal with laser diode emission in both the fast and slow axis, as well as collimation, are found in fiber optic communications, as well as the high power laser diode writing, scribing, and engraving industry.

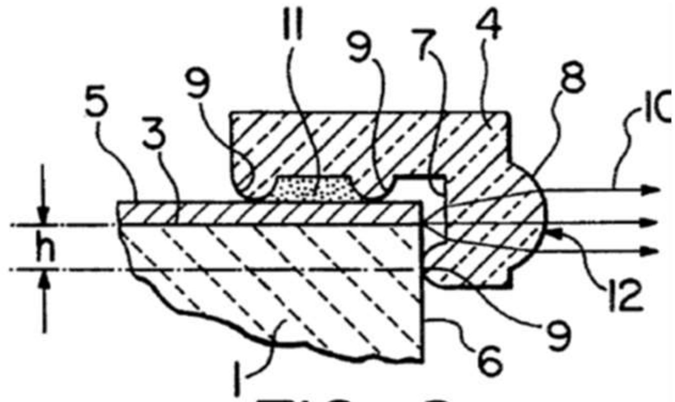


FIG. 2

19. The shape of the microlens in the ’722 patent is [redacted]

[redacted]

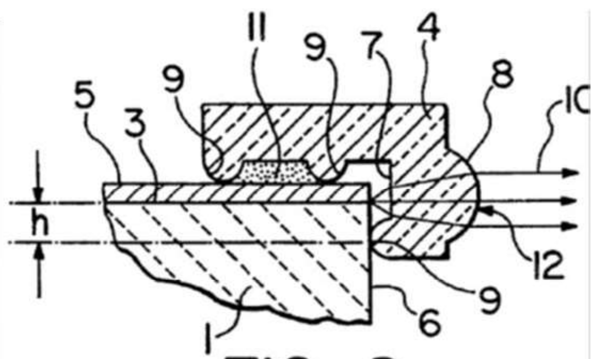


FIG. 2

’722 Patent Lens

20. [redacted]. The ’722 patent demonstrates that [redacted]

21. U.S. Patent No. 5,825,054, which claims priority to December 29, 1995, discloses how “[t]he coupling process of the semiconductor laser and the focusing lens can be accomplished before sealing all parts on the header within a cap, thus providing the semiconductor laser apparatus with high output power.” (Ex. 7, ’054 patent at 2:16-21.) The “cap can be formed by injection molding transparent acrylic resin such as PC or PMMA and

coating AR (anti-reflection)-coated on both sides of the front end of the cap" and "on the top (i.e., the front end) of the cap, different kinds of lens, such as a spherical lens, aspherical lens and Fresnel lens, can be formed for collimating and focusing." (Ex. 7, '054 patent at 2:33-39.) As illustrated in Figure 3a, a transparent cap 23 is mounted in front of the semiconductor laser chip 26, and "[t]he manner of sealing the apparatus as shown in FIG. 3a is to fit the inner circumference of the cap 23 to the flange of the plastic-molded header 22," which is then sealed by epoxy 24. (*Id.* at 3:33-35.) Figures 5a, 5b, and 5c, for example, illustrate mounting a spherical or aspherical convex lens, a spherical convex lens and a holographic film, and a Fresnel lens respectively. These figures [redacted].

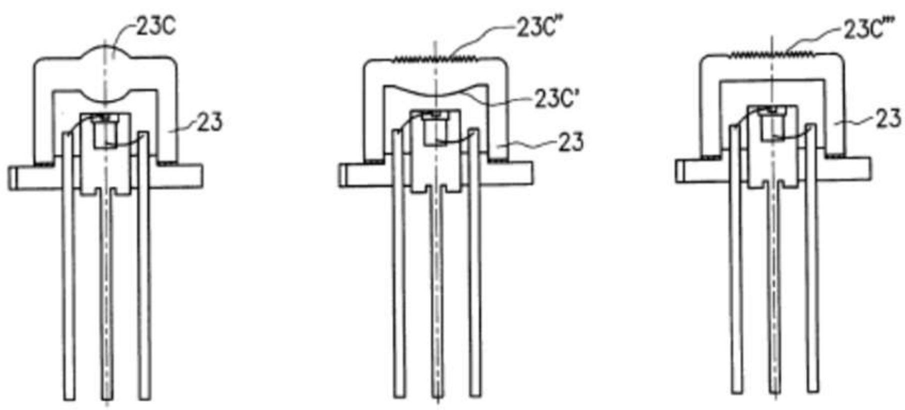


FIG. 5a FIG. 5b FIG. 5c

22. The laser diode light emission passes through the injection-molded lens for optical lensing. The cap is designed to be positioned beside the laser emission path and is aligned into position and then attached to the package via epoxy 24. This type of package is commonplace in the laser diode industry and the basic design was first used in the 1950s and 1960s. The package is called a TO-header where the letters TO stand for Transistor Outline. Over the years, the package has become so popular that the original structure has been used as the work horse for lasers, LEDs, photodetectors, and transistors.

23. Ever since the first semiconductor room temperature laser diode was demonstrated by Bell Labs in the late 1960s, engineers have been aware of how laser light is emitted from the

chip. The issues of fast axis, slow axis, collimation and focusing were well known principles in optics even before the semiconductor laser diode chip was demonstrated. Using a lens in front of a laser chip is part of an optical engineer's basic skill set, as the light diverges quickly and optics are needed to efficiently utilize the emitted light. In the 1970s, glass lenses were used, but as laser diodes entered high-volume manufacturing with products such as CD players in the 1980s, the drive to lower costs, miniaturize size, and increase functionality meant the optics industry quickly developed injection-molded techniques to manufacture lenses. Engineers have used optical lenses for LiDAR systems for over 20 years knowing that they have a choice of materials to utilize that include glass, plastic, and other materials such as sapphire. The use of injection-molded plastic lenses has been successful in products that require reduction in costs, and which need to scale to high volume and the choice for injection-molded lenses in LiDAR is obvious to any optoelectronics engineer today.

24. I understand from reviewing the Supplemental Declaration of James Haslim that the [redacted] on the Fuji transmit boards have the following features that differentiate them from [redacted]: (1) [redacted]; (2) [redacted]; and (3) [redacted]. The drawing of the Fuji [redacted] is reproduced below.

[redacted]

25. Below, the figure on the left is the [redacted] in the [redacted], which is designed to [redacted] (Jaffe Decl. Ex. 1 ¶ 9.) On the right is [redacted]

[redacted]. The figures show that the Fuji does not use the design of the [redacted].

[redacted]

26. At his deposition, Mr. Kintz [redacted]. (Ex. 2, Kintz Dep. Tr. at 169:18-170:21.) Mr. Kintz [redacted] (*Id.* at 196:9-15.) As shown above, the Fuji's [redacted], and Uber does not use Waymo's alleged trade secret, which is directed to a [redacted]

C. [redacted]

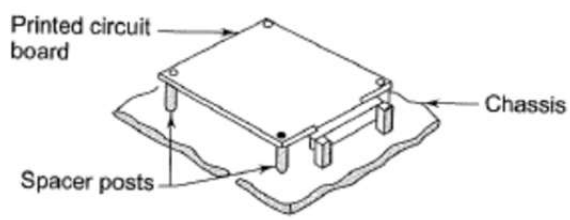
Waymo claims: [redacted]

27. Mr. Kintz states in Paragraphs 64 to 65 of his Reply Declaration that the concept of [redacted] is a Waymo trade secret. Mr. Kintz appears to equate [redacted]

28. I disagree with Mr. Kintz that this is a trade secret. The use of [redacted] is a known technique in the PCB industry, and has been for a number of decades now. This technique has been discussed in public references and [redacted] are available for sale on public websites of component vendors. (Ex. 8, Digikey webpage for [redacted]; Ex. 9, Alibaba search results;

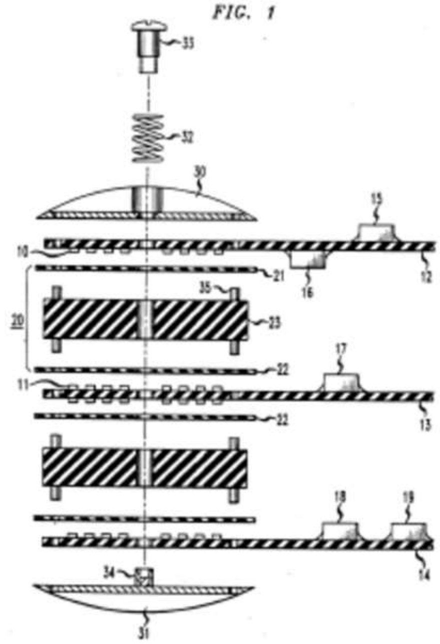
Ex. 10, Amazon webpage for [redacted].) Generally, in any electronic system that utilizes a PCB, the PCB is positioned and raised from the case, module, shell, box etc. in which it is disposed. In order to raise the PCB, [redacted] are used. If two PCBs are used, then each PCB is stacked using [redacted]. Catalogs from distributors such as DigiKey, which is a large distributor of electronic components and parts, have pages of different kinds of PCB [redacted] in different materials (e.g., steel, brass, aluminum), shapes, and sizes. [redacted] PCBs is not new – it is a very common technique practiced by many electronics companies around the world today. Mr. Kintz has acknowledged at deposition that [redacted] (Ex. 2, Kintz Dep. Tr. at 232:23-233:3.)

29. The illustration below from *Printed Circuit Boards*: *Design, Fabrication, Assembly and Testing,* a publicly-available reference authored by R. S. Khandpur, shows [redacted] (Ex. 11.)



(b) Mount on tapped spacers
Any size board can be accommodated by this simple mounting. It can be a space-saver on walls and doors of enclosures.

30. U.S. Patent No. 5,334,029 explains that, for "stacked arrays of printed circuit boards with integrated circuit (IC) and other components mounted thereon," the use of a "spacer is required to ensure sufficient board separation to accommodate the components and to allow for cooling air flow." (Ex. 12, '029 patent at 1:8-17.) Figure 1 illustrates the use of spacer elements 23 to connect stacked circuit boards 12, 13, and 14.



31. The concept of [redacted] is also not a trade secret. Many PCB designs have different thicknesses, especially if highly complex electronic and optoelectronic layouts for circuits are necessary. For example, a simple electronic and optoelectronic circuit may require only a 1, 2 or 3 level PCB. This means that only 1, 2 or 3 metal layers are needed in the composition of the PCB. Other more complex circuit designs may require 7, 8, 9, 10 or even more levels of metal as part of the composition of the PCB. In this case, the board is much thicker, probably stiffer, and more expensive. In today's world, the size, complexity, thickness, and ultimate composition of the PCB is a major feature in the overall product design. Thickness is one of the parameters that all engineers are aware of when they design and specify PCB boards from manufacturers. In fact, the number of metal levels, thickness, and composition are typically part of the technical specification engineers draw up when ordering PCBs. When PCBs are stacked together, for fiber optic communications (optical switches, optical serves, backplanes, racks, etc.), LiDAR, or any other optoelectronic system, the thickness of PCBs is a critical specification that needs to be addressed early in the design.

32. In the context of using [redacted] in a system for conveying PCBs along an assembly line, U.S. Patent No. 6,863,170 is directed to a method of "selecting said spacer from a plurality

of spacers as a function of its thickness and a thickness profile of said printed circuit board" and installing the [redacted] (Ex. 13, '170 patent at Claim 1.)

33. U.S. Patent No. 8,593,828, the application for which was published on August 4, 2011, discloses PCBs separated by [redacted] that permit slight movement of the PCBs to ensure proper positioning "when tolerances are tight." (Ex. 14, '828 patent at 16:19-22.) Fig. 26A shows [redacted] ("standoffs 196") separating two PCBs (86). The patent discloses that "the standoff 196 is allowed to float about the top PCB 86A to allow the positioning or orientation of the top PCB 86A to move slightly in the X, Y, or Z directions with regard to the bottom PCB 86B." (*Id.* at 16:43-47.)

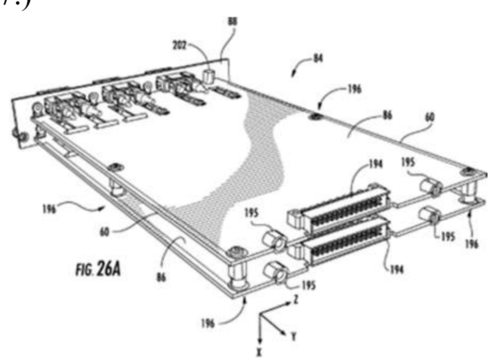


FIG. 26A

34. As explained above, the use of [redacted], is well known and not a trade secret.

D. [redacted]

<u>Waymo claims:</u> [redacted]

35. Mr. Kintz states in Paragraphs 67 to 71 of his Reply Declaration that the concept of [redacted] is a Waymo trade secret. I disagree with Mr. Kintz. The use of an [redacted] is a known technique in LiDAR and other optical systems. This technique has been discussed in patent literature and [redacted] are available for sale on public websites of component vendors. (Mr. Kintz [redacted]

[redacted]. (Ex. 2, Kintz Dep. Tr. at 205:21-24.))

36. U.S. Patent No. 7,187,823, which has a priority date of March 16, 2004, discusses a solution to "overcome deficiencies in existing scanning systems by changing the way in which power and information are transmitted between rotary and stationary portions of a system." (Ex. 15, '823 patent at 4:40-44.) The scanning systems in question include "LiDAR systems." (*Id.* at 1:35-53.) The '823 patent discloses using an optical link "[i]n order to allow an optical signal to be passed between a data interface 422 of a stationary portion of the FDV and an optical transceiver 420 in a rotary frame, for example, which can be rotatable with respect to each other." (*Id.* at 7:7-10.)

37. This optical link is "a single optical fiber 414," where "[t]he fiber can be a single, continuous fiber, or can consist of a first fiber portion 414 and a second fiber portion 416" that "connect through a rotary connection . . . allowing the portions of the fiber to rotate with respect to one another while allowing for a common light path." (*Id.* at 7:20-27.) In other words, the '823 patent discloses [redacted]

38. The '823 patent provides figures to illustrate [redacted] As illustrated in Figure 5, an [redacted] can be used "to transfer information between an optical transceiver 512 and data interface 514." (*Id.* at 8:21-23.)

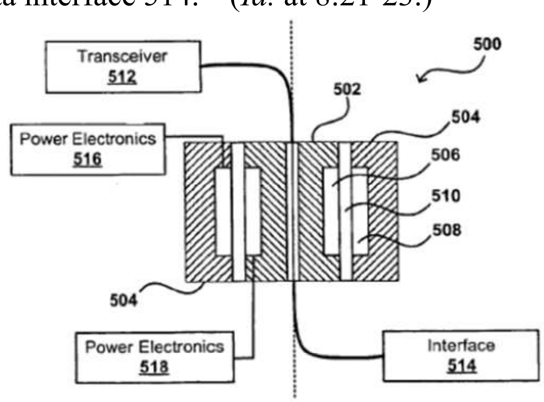


FIG. 5

39. The '823 patent also shows the use of a [redacted]. Figure 7a shows "a first fiber portion 700 and a second fiber portion 706" that with a [redacted] comprising "an accepting connection member 704" and "a projecting connection member 710, shaped to be received by the accepting connection member 704." (*Id.* at 7:36-50.)

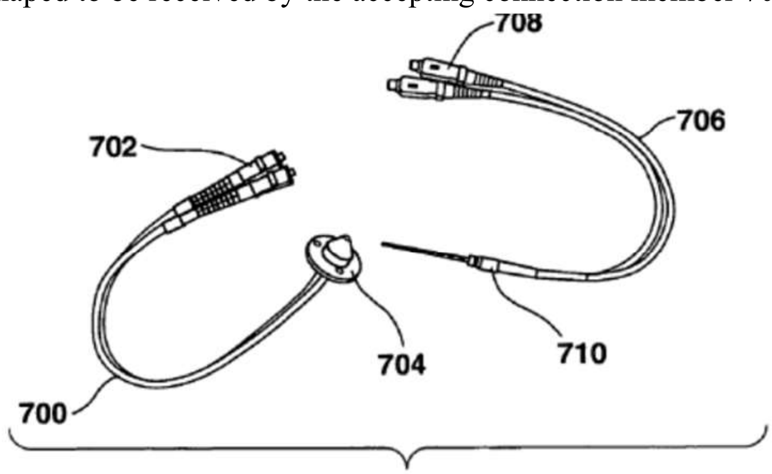


FIG. 7(a)

40. A quick look on the Internet for only a few minutes generated a long list of vendors that can supply [redacted] for varying prices and specifications. Such vendors include the following:

> Princetel (for [redacted] http://www.princetel.com/product_forj.asp (Ex. 16.)
>
> Moog: http://www.moog.com/products/fiber-optic-devices/fiber-optic-rotary-joints/ (Ex. 17.)
>
> Thorlabs (for [redacted] https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=7556 (Ex. 18.)
>
> Doric (for [redacted]): http://doriclenses.com/life-sciences/193-fiber-optic-rotary-joints (Ex. 19.)
>
> Laser components ([redacted]): http://www.lasercomponents.com/de-en/product/fiber-optic-rotary-joints/ (Ex. 20.)

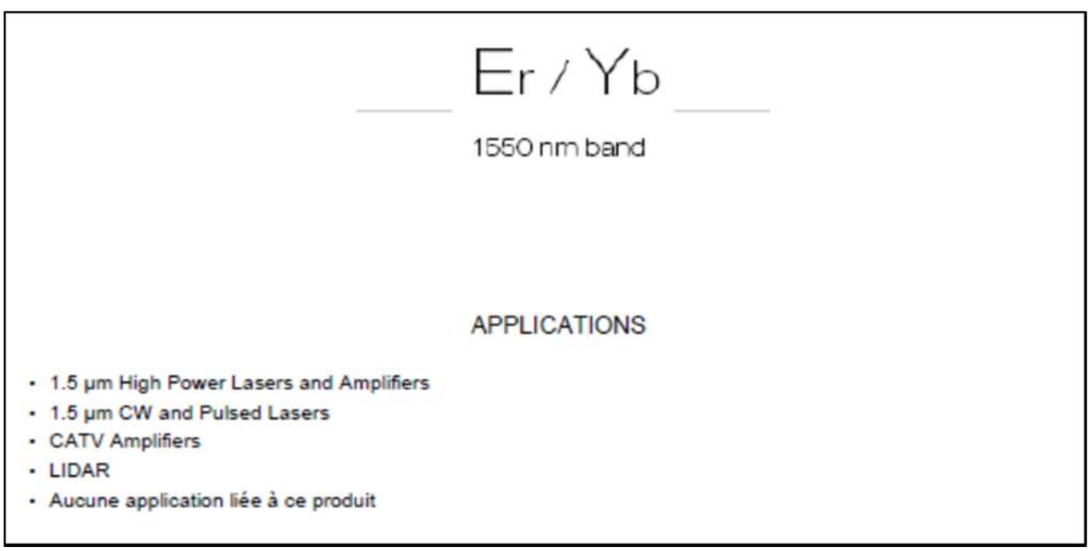
41. From my review of the Supplemental Declaration of James Haslim and my conversation with Mr. Haslim, I understand that Uber has purchased off-the-shelf [redacted] from Princetel for its Fuji LiDAR.

E. [redacted]

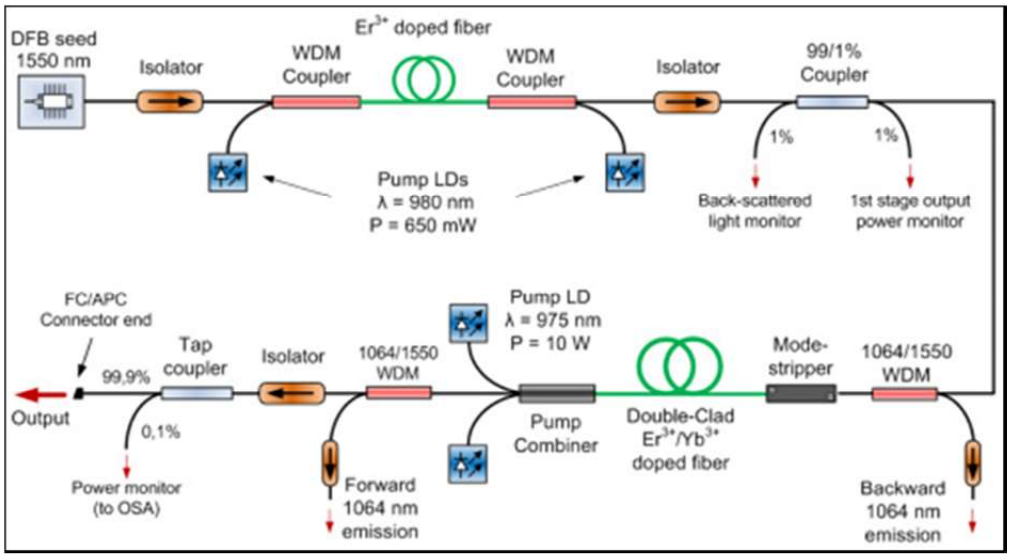
Waymo claims: [redacted]

Waymo also claims [redacted]

42. Mr. Kintz states in Paragraphs 72 to 79 of his Reply Declaration that the concept of [redacted] is a Waymo trade secret. I disagree with Mr. Kintz. The use of [redacted] is a well-known technique in optical systems. This technique has been discussed in public references, and [redacted] are available from public vendor websites. For example, iXblue advertises [redacted] for use in high power lasers and expressly discloses that such [redacted] may be used for LiDAR applications, as shown in the screenshot below of https://photonics.ixblue.com/products-list-detail/erbium-ytterbium-double-clad-doped-fibers. (Ex. 21; *see also* Ex. 22 (https://www.newport.com/f/erbium-&-ytterbium-doped-fibers).) Mr. Kintz [redacted] (Ex. 2, Kintz Dep. Tr. at 193:10-18.)



43. A number of publicly available references discuss the use of [redacted]. For example, the diagram below is publicly available from a 2011 paper titled “Controlling the 1 µm spontaneous emission in Er/Yb co-doped fiber amplifiers,” and it describes using an [redacted]. (Ex. 23.)



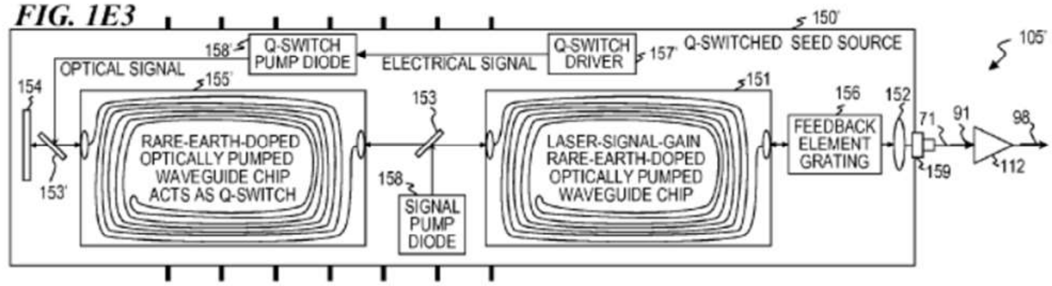
44. [redacted], as illustrated above, generates more optical power than single-stage amplification. The reason engineers choose [redacted] is that they need higher stability with increased optical output power emerging from the [redacted] [redacted]. As can be seen in the figure above, all fiber amplifiers have a source laser and pump lasers – in this case the source or pump laser is a DFB 1550nm laser. DFB stands for “distributed feedback” laser and has properties of narrow linewidth and high performance. The pump laser diodes have a shorter wavelength (980nm) and are also coupled into the main optical channel with the 1550nm DFB laser. The light entering the first amplifier is composed of both 1550nm and 980nm light. The 980nm light excites the [redacted] in the glass fiber and promotes optical gain or amplification of the light. In some systems, the optical output power level of amplified optical light is enough using only one amplifier, but [redacted] is popular, especially in LiDAR, laser cutting, and fiber communications. The light from the first amplifier is coupled to

the entrance of the [redacted], and pump laser diodes are again used to further increase the optical gain of the signal. In the [redacted] high-output pump laser diodes are used, and the other [redacted] are used to further increase the performance of the [redacted]. Typically in the industry, another [redacted]. Using [redacted] has been developed over a number of decades, and is a standard approach for [redacted] design. The optical output power level emerging from the [redacted] is higher than the first, and, depending on the system design, can be used as a high power source for optical processing with high levels of stability.

45. U.S. Patent No. 8,934,509 discloses enabling "higher-pulse-energy signals that provide a longer range for illuminators for long-range image-acquisition systems (illuminating scenes for cameras), and improved light-distancing-and-ranging (LIDAR) systems." (Ex. 24, '509 patent at 9:14-18.) In particular, the patent discloses: "a semiconductor laser diode 158', and the signal-amplifier planar waveguide optical amplifier 155' is doped with Er (erbium) or co-doped with YbEr (ytterbium and erbium) that amplifies signal light of about 1550 nm when its pump light is supplied by semiconductor laser diode 158." (*Id.* at 25:3-7.) This is shown in Figure 1E3 below. The patent also describes an alternative embodiment, illustrated in Figure 1F3 (not shown), where "the power amplifier is an erbium-doped fiber amplifier (EDFA) or an erbium-ytterbium co-doped fiber amplifier (EYDFA)." (*Id.* at 29:44-46.)

46. As explained in the '509 patent, when "supplied with sufficient optical pump light from Q-switch pump source 158', optical amplifier 155' becomes transparent to, or amplifying of, light of the signal wavelength and the Q-switch is 'on.'" (*Id.* at 24:41-45.) When the Q-switch is on, "lasing begins and the stored energy in [rare earth dopant ions in] optical-gain medium 151 is output as seed signal pulse 91." (*Id.* at 24:50-52.)

FIG. 1E3



47. Based on my review of the Supplemental Declaration of James Haslim and my conversation with Mr. Haslim, Uber purchased off-the-shelf [redacted] from publicly known vendor iXblue for the Spider.[16]

IV. MR. KINTZ'S SUPPLEMENTAL OPINIONS ON WAYMO'S ORIGINAL TRADE SECRET ALLEGATIONS

48. As I discussed above, Mr. Kintz ignores the many quantitative differences in critical parameters between the Fuji and [redacted] boards. Instead, he focuses on broad concepts that he claims are Waymo's trade secrets– [redacted]. None of these concepts, however, are trade secrets. The general features that Waymo claims as its own are known design choices in the fields of LiDAR and diode lasers. Below, I address supplemental opinions that Mr. Kintz provided for the first time in his Reply Declaration.

A. [redacted] of Diodes (TS List No. 1)

49. Waymo claims: [redacted] As Dr. McManamon explained in his Declaration, this concept is not a trade secret because the idea of having [redacted]

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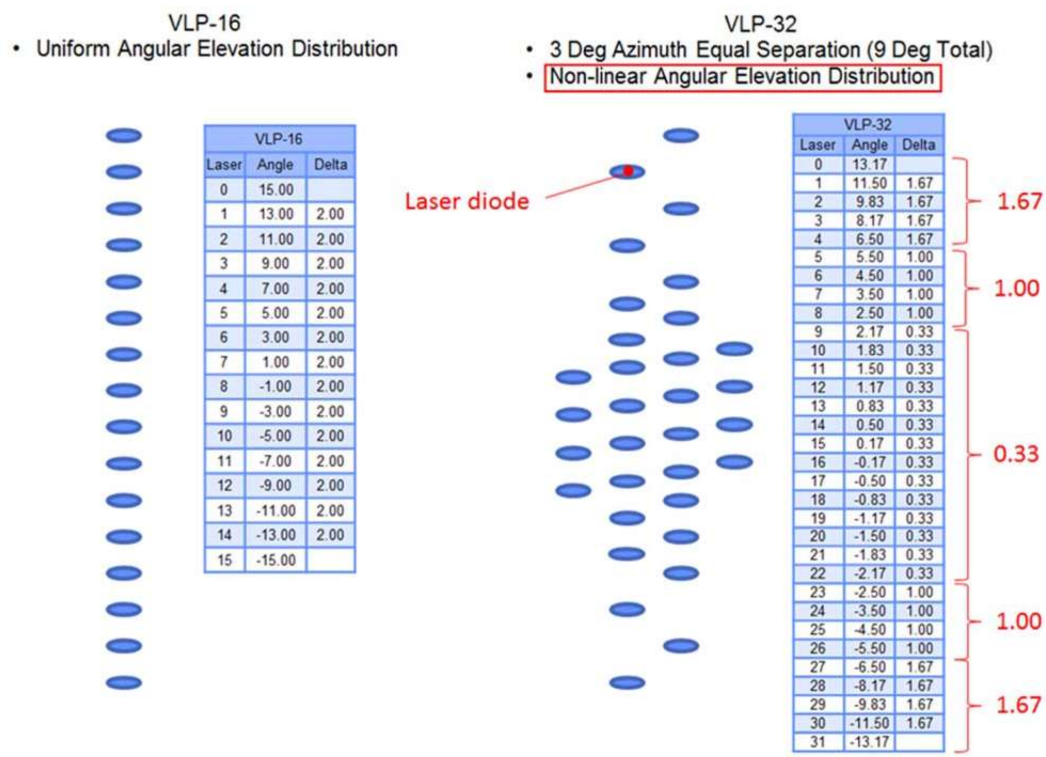
[16] Based on my conversation with Mr. Haslim, my inspection of the Spider components, and the Haslim Supplemental Declaration, the Spider was a fiber laser design, and Uber only built a few components before abandoning the design. Uber never built all the components, assembled all the parts, or created a functional prototype. (Haslim Supp. Decl. ¶ 2.) I also note Mr. Kintz said [redacted] (Ex. 2, Kintz Dep. Tr. at 231:24-232:2.)

[redacted] was known to LiDAR designers who were completely independent of Waymo, including Mr. Boehmke and Velodyne.

50. In his Reply Declaration, Mr. Kintz opines that the work of Mr. Boehmke and Mr. Haslim was not an independent development of the [redacted] in the Fuji. As I explain below, Mr. Boehmke and Mr. Haslim's documents show their independent work.

51. Mr. Boehmke developed a [redacted] laser diode design in 2015. His October 2015 "LADAR Design Notebook" shows a pattern of 32 diodes, with the [redacted]. (Supp. Boehmke Decl. ¶ 3 (annotated Figure 1 reproduced below).) An accompanying chart shows the precise [redacted] parameters (angles and deltas).



VLP-16		
Laser	Angle	Delta
0	15.00	
1	13.00	2.00
2	11.00	2.00
3	9.00	2.00
4	7.00	2.00
5	5.00	2.00
6	3.00	2.00
7	1.00	2.00
8	-1.00	2.00
9	-3.00	2.00
10	-5.00	2.00
11	-7.00	2.00
12	-9.00	2.00
13	-11.00	2.00
14	-13.00	2.00
15	-15.00	

VLP-32		
Laser	Angle	Delta
0	13.17	
1	11.50	1.67
2	9.83	1.67
3	8.17	1.67
4	6.50	1.67
5	5.50	1.00
6	4.50	1.00
7	3.50	1.00
8	2.50	1.00
9	2.17	0.33
10	1.83	0.33
11	1.50	0.33
12	1.17	0.33
13	0.83	0.33
14	0.50	0.33
15	0.17	0.33
16	-0.17	0.33
17	-0.50	0.33
18	-0.83	0.33
19	-1.17	0.33
20	-1.50	0.33
21	-1.83	0.33
22	-2.17	0.33
23	-2.50	1.00
24	-3.50	1.00
25	-4.50	1.00
26	-5.50	1.00
27	-6.50	1.67
28	-8.17	1.67
29	-9.83	1.67
30	-11.50	1.67
31	-13.17	

52. In December 2015, Boehmke sent [redacted] a LiDAR scan pattern with horizontal lines showing [redacted] of the laser beams produced by the diodes, as shown in the annotated figures below. (*Id.* ¶ 4, Figure 2.A, Figure 2.B.)

[redacted]

Figure 2.A

Laser Channel	Vertical Range Position from top	Beam Separation (degrees)	Max Range at 20% (m)
1	14.87	-	100
2	12.87	2.00	100
3	10.87	2.00	100
4	9.37	1.50	100
5	8.37	1.00	100
6	7.57	0.80	100
7	6.97	0.60	100
8	6.47	0.50	100
9	6.07	0.40	100
10	5.67	0.40	100
11	5.33	0.33	100
12	5.00	0.33	100
13	4.67	0.33	100
14	4.33	0.33	100
15	4.00	0.33	100

Figure 2.B

53. These documents demonstrate that Mr. Boehmke knew the concept of [redacted] in 2015. The Supplemental Declarations of Mr. Boehmke and Mr. Haslim further explain how the [redacted] parameters provided to [redacted] eventually became the basis for the current beam angles of the Fuji.[17]

54. As explained in Dr. McManamon's declaration, the Velodyne '190 patent demonstrates that Velodyne, the leading manufacturer of automotive LiDAR systems, had already conceived and publicly disclosed the concept of [redacted] at least as early as September 2011. Mr. Kintz states in his Reply Declaration that this patent does not show [redacted] in a single LiDAR device.[18] However, the patent specifically discloses a LiDAR system with [redacted]: "The density of emitter/detector pairs populated along the vertical FOV is intentionally ***variable***. . . . For some uses ***increased density*** is desirable to facilitate seeing objects at ***further distances and with more vertical resolution***." ('190 patent at 6:45-56, McManamon Decl. Ex. 3; MacManamon

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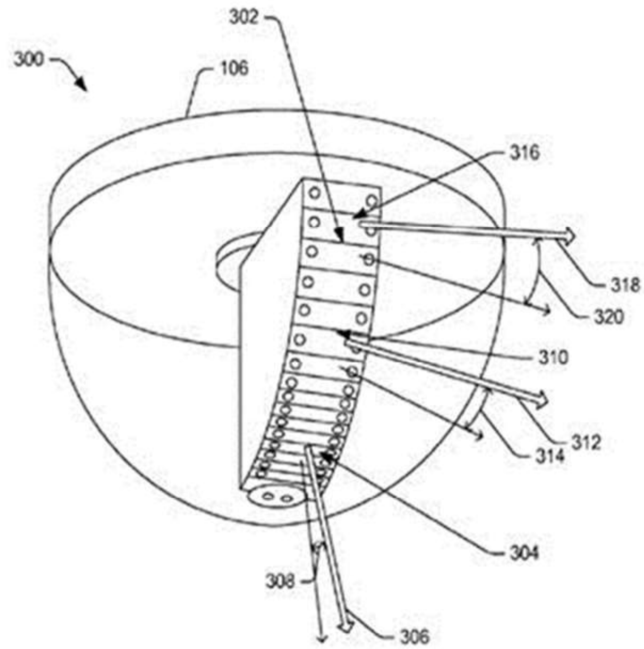
[17] Mr. Kintz states in Paragraph 8 of his Reply Declaration that when working to develop custom beam angles with [redacted], Uber "considered, and ultimately rejected" the dual-stack approach of the PanDAR system identified in Dr. McManamon's Declaration. This is incorrect. The PanDAR paper discusses using two off-the-shelf Velodyne 32-channel LiDARs to create a denser region of overlapping beams. In contrast, Uber has been working with [redacted] to develop custom beam pattern, with variable beam spacing.

[18] At deposition, Mr. Kintz [redacted] (Ex. 2, Kintz Dep. Tr. at 154:1-25.)

Decl. ¶¶ 54-58.) Waymo argues that the ’190 patent does not teach [redacted] (Repl. 4.) That is incorrect – the patent teaches [redacted] in a single LiDAR system by choosing to include more diodes in certain parts of the vertical FOV. (’190 patent at 6:45-56.) Waymo contends that the ’190 patent “does not teach any [redacted],” but it does teach [redacted], which is [redacted]. (Repl. 4.)

55. Though his opening Declaration only referred to [redacted], Mr. Kintz states for the first time in his Reply Declaration that Waymo’s trade secret is the concept of [redacted], which he clarified to mean that [redacted] (Ex. 2, Kintz Dep. Tr. at 63:6-14.) But even the concept of [redacted] is known to the public. U.S. Patent Application No. 2016/0291136, filed in 2015, describes a rotating LiDAR system with “inconsistent spacing between LiDAR components,” where each LiDAR component includes a laser emitter and detector configured in a frame. (Ex. 25, ’136 application at [0014], [0026].) The application discloses first angle 308, second angle 314, and third angle 320, where each angle is the angle between the direction of one LiDAR component (i.e. direction of the emitter diode) and the direction of the adjacent LiDAR component. (*Id.* at [0026].) The application discloses an embodiment where “the first angle 308 may be less than the second angle 314 and the second angle 314 may be less than the third angle 320.” (*Id.*) This description is the [redacted]



56. Furthermore, the Fuji does not use [redacted] as defined by Mr. Kintz in his deposition. He stated that the [redacted] (Ex. 2, Kintz Dep. Tr. at 63:6-14.) He also said that [redacted] or [redacted] (*Id.* at 63:15-64:14.) From the Supplemental Declaration of James Haslim, I have identified the current beam angles in the Fuji's medium-range cavity (diodes on boards A-C) and long-range cavity (diodes on boards D-F) in the tables below.[19] Using these beam angles, I calculated the spacing (i.e. the "delta in degrees," or the difference in angle between one diode and the diode preceding it).[20] As you can see below, most of the boards have portions where the [redacted]. In particular, the D-F boards for the long-range cavity have fairly uniform spacing across the entire boards. The A-C boards have portions where the [redacted]

[19] The beam angles for the medium-range cavity are adjusted for the negative 12-degree tilt of that cavity.

[20] The difference in angle has been rounded to the second decimal point.

[redacted]. By Mr. Kintz's own definition, Uber does not use Waymo's alleged trade secret.

[redacted]

57. **TS List Nos. 4, 6, 28-30, 39, 94-99:** Waymo's reply brief states that Uber uses TS List No. 4, a [redacted]. (Repl. 3.) But Mr. Kintz did not specifically address this alleged trade secret in his opening declaration. The Fuji board has a minimum spacing of [redacted] between diodes, not the [redacted] claimed by Waymo.[21] (Haslim Decl. ¶ 11.) Mr. Kintz's Reply Declaration identifies (but does not address) alleged Trade Secret

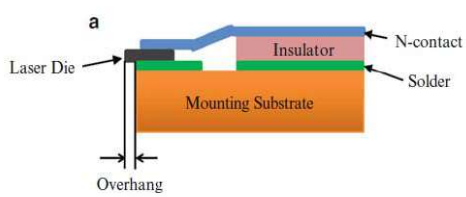
[21] Mr. Boehmke explains in his Supplemental Declaration how he independently developed 2.3 mm spacing for laser diodes, as shown by a printed circuit board layout created on March 29, 2016. (Supp. Boehmke Decl. ¶ 8 and Figure 5.B.)

Nos. 6, 28-30, 39, 94-99, but these alleged trade secrets are directed to the [redacted]'s specific parameters, schematics, and design files. As I explained above, the Fuji and [redacted] boards were designed for different vertical fields of view and have many quantitative differences in critical parameters, including different vertical angles for nearly every laser diode on every transmit board and different angular deltas between diodes. It is my opinion that Uber is not using any of Waymo's alleged trade secrets Nos. 4, 6, 28-30, 39, 94-99.

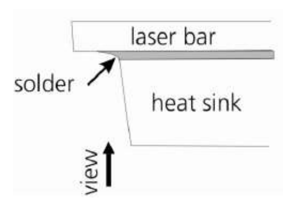
B. [redacted] (TS List No. 7)

58. Waymo claims: [redacted] The concept of positioning a laser diode to [redacted] is not a secret, as it is disclosed in public literature and used in Velodyne's LiDARs.

59. As discussed in my opening Declaration at Paragraphs 49 to 51, [redacted] are clearly illustrated and discussed in a 2015 textbook on semiconductor lasers and a 2007 dissertation on laser diode systems (see figures and excerpts below):



2015 Liu Textbook, p. 224: "Overhang and underhang characterize the alignment between the diode laser die (could be a single emitter chip or a bar) and the mounting substrate." (Ex. 3 to opening Declaration.)



2007 Scholz Dissertation, p. 63: "The laser bar is mounted with a small overhang on the top of the heat sink." (Ex. 4 to opening Declaration.)

60. Mr. Kintz argues in his Reply Declaration that the Liu Textbook teaches away from using an [redacted]. (Repl. 5.) I understand, however, that in the law of trade secrets, public disclosure of the concept breaks the secret. Mr. Kintz also contends that the references do not disclose a [redacted] (*id.*), but Mr. Kintz [redacted] (Ex. 2, Kintz Dep. Tr. 115:6-13.) Though Mr. Kintz [redacted] (*Id.* at 123:4-8, 125:10-20.) Mr. Kintz also

[redacted] (*Id.* at 112:2-23, 114:14-25.)

61. [redacted] are also known and used in the automotive LiDAR field in particular. I understand that Uber engineer Dan Gruver testified based on his personal experience [redacted] (Ex. 26, Gruver Dep. Tr. at 51:4-52:5.)

C. [redacted] (TS List No. 2, 3)

62. Waymo claims: [redacted] Mr. Kintz argues in his Reply Declaration that Fuji's use of [redacted] (Repl. 6; Kintz Reply Decl. ¶ 27.) To the contrary, Fuji's arrangement of lasers is a physically and functionally distinct design from [redacted], reflecting Fuji's fundamentally different two-cavity, multi-lens structure. While [redacted] has [redacted], Fuji's [redacted] are each separately (1) mounted in different LiDAR cavities, (2) aligned to permit laser light to pass through two lenses, and (3) paired with flat receive boards with three columns of photoreceptors. At deposition, Mr. Kintz [redacted] (Ex. 2, Kintz Dep. Tr. 160:3-11; *see also id.* at 158:7-160:2.) Mr. Kintz's testimony further shows that [redacted] and [redacted] are fundamentally distinct.

63. Mr. Kintz also tries to dismiss Fuji's [redacted] as a "minor modification," even though the [redacted] is what Waymo claims provides the alleged benefit of trade secret 3 (i.e., [redacted]). Fuji's [redacted] is the exact opposite (i.e., [redacted]).

64. As I previously explained, once the choice was made to use [redacted] (a number that comes from Velodyne, not Waymo),[22] distributing those in a [redacted] (or even [redacted]) was an obvious configuration that designers would have considered in view of known design considerations, and a [redacted] is illustrated in the Liu Textbook. (Ex. 4 to opening Declaration at 111 (Figure 5.3).) Moreover, Waymo's own '922 patent publicly discloses the use of four boards with 16 light sources on each. ('922 patent at 9:20-23.) Such distributions of lasers are part of general engineering know-how in the diode laser field.

D. [redacted] (TS List No. 14)

65. Waymo claims: [redacted] Mr. Kintz argues in his Reply Declaration that there is not a single reference that discloses using [redacted] But U.S. Patent No. 4,244,109 discloses [redacted] (*see* Fig. 3, below), [redacted].

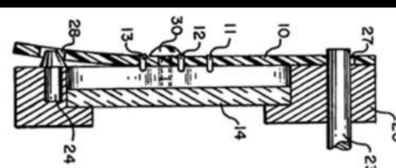


FIG. 3

66. The patent also discloses that [redacted]: "[T]he photodiodes are mounted on the PCB in alignment with the two holes." (Ex. 6 to opening Declaration, '109 patent at 3:27-28.) Mr. Kintz [redacted]. (Ex. 2, Kintz Dep. Tr. at 188:2-5.) [redacted]

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[22] Mr. Kintz [redacted]. (Ex. 2, Kintz Dep. Tr. at 101:21-23.)

[23] I note that Waymo's Trade Secrets List says that the [redacted]. (Ex. 2, Kintz Dep. Tr. at 189:4-190:14.)

V. REVIEW OF WAYMO AND UBER FILES

67. I understand that Waymo's counsel identified a list of top fifty files from among the 14,000 files allegedly downloaded by Anthony Levandowski. (Ex. 27.) I have inspected the fifty files on a source code computer at the office of Waymo's counsel. The fifty files contain [redacted]

68. The information in the fifty files is [redacted] that I previously reviewed. The fifty files do not cause me to change any of the opinions in my opening Declaration.

69. I note that [redacted]

70. I also note that the fifty files do not show how to use certain concepts in Waymo's alleged trade secrets. For example, the fifty files do not include information on [redacted]. The fifty files also do not show how to [redacted] Though the [redacted] (At his deposition, Mr. Kintz [redacted] (Ex. 2, Kintz Dep. Tr. at 230:9-231:23.)[24]

71. In addition, I also reviewed nine unique Uber files that are hash-matched to some of the allegedly downloaded 14,000 files. I was able to open the .txt files (11200733.txt,

[24] He also [redacted]. (*Id.* at 230:13-231:3.)

11200747.txt, 130143.txt, and 130145.txt) and confirm that they did not contain any alleged Waymo trade secrets. Though I was unable to open three PrjPcbStructure files, from experience I can confirm that these would be structure listings that do not contain substantive information of their own. I was unable to open an attrlist file and a .tools file.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct. Executed this 28th day of April, 2017, in Denver, Colorado.

Michael Lebby, Ph.D.